

What is claimed is:

1. A hydraulic control apparatus for a hybrid vehicle comprising:
 - an engine and a motor as power sources of the hybrid vehicle;
 - a transmission which is provided for transmitting powers of the engine and the motor to output shafts of the hybrid vehicle, and which includes a torque converter, a starting gear, and a clutch that controls an engagement state of the starting gear by being supplied with oil pressure;
 - a hydraulic control circuit associated with the transmission;
 - a motor-driven oil pump for supplying oil pressure to the hydraulic control circuit and the clutch;
 - an engine automatic stop and start device which is associated with the engine in order to stop and start the engine under predetermined conditions;
 - a control unit which is operatively connected to the engine automatic stop and start device, the motor-driven oil pump, and the hydraulic control circuit;
 - a brake pedal depression detecting device which is provided for detecting whether the brake pedal of the hybrid vehicle is depressed, and which is connected to the control unit;
 - an accelerator pedal depression detecting device which is provided for detecting whether the accelerator pedal of the hybrid vehicle is depressed, and which is connected to the control unit; and
 - an engine revolution rate measuring device which is provided for sensing revolution rate of the engine, and which is connected to the control unit,
 - wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is set to be a first oil pressure while the engine is automatically stopped,

wherein the control unit is adapted to operate the engine automatic stop and start device so as to start the engine when it is determined by the brake pedal depression detecting device that the brake pedal is released while the engine is automatically stopped, and

wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is maintained to be the first oil pressure when the engine is automatically started upon detecting release of the brake pedal, it is determined by the accelerator pedal depression detecting device that the accelerator pedal of the hybrid vehicle is not depressed, and it is determined by the engine revolution rate measuring device that the engine revolution rate is equal to or less than an idling revolution rate.

2. A hydraulic control apparatus for a hybrid vehicle according to claim 1, wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is increased from the first oil pressure to a second oil pressure when it is determined by the engine revolution rate measuring device that the engine revolution rate exceeds the idling revolution rate.

3. A hydraulic control apparatus for a hybrid vehicle comprising:

- an engine and a motor as power sources of the hybrid vehicle;
- a transmission which is provided for transmitting powers of the engine and the motor to output shafts of the hybrid vehicle, and which includes a torque converter, a starting gear, and a clutch that controls an engagement state of the starting gear by being supplied with oil pressure;
- a hydraulic control circuit associated with the transmission;
- a motor-driven oil pump for supplying oil pressure to the hydraulic control circuit

and the clutch;

an engine automatic stop and start device which is associated with the engine in order to stop and start the engine under predetermined conditions;

a control unit which is operatively connected to the engine automatic stop and start device, the motor-driven oil pump, and the hydraulic control circuit;

a brake pedal depression detecting device which is provided for detecting whether the brake pedal of the hybrid vehicle is depressed, and which is connected to the control unit;

an accelerator pedal depression detecting device which is provided for detecting whether the accelerator pedal of the hybrid vehicle is depressed, and which is connected to the control unit; and

an engine revolution rate measuring device which is provided for sensing revolution rate of the engine, and which is connected to the control unit,

wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is set to be a first oil pressure while the engine is automatically stopped,

wherein the control unit is adapted to operate the engine automatic stop and start device so as to start the engine when it is determined by the brake pedal depression detecting device that the brake pedal is released while the engine is automatically stopped, and

wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is decreased from the first oil pressure when the engine is automatically started upon detecting release of the brake pedal, and it is determined by the accelerator pedal depression detecting device that the accelerator pedal of the hybrid vehicle is not depressed, and then to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is increased to a second oil pressure which is greater than the first oil pressure when it is

determined by the engine revolution rate measuring device that the engine revolution rate exceeds a predetermined revolution rate or when it is determined that a predetermined time has passed since the engine was automatically started.

4. A hydraulic control apparatus for a hybrid vehicle comprising:

an engine and a motor as power sources of the hybrid vehicle;

a transmission which is provided for transmitting powers of the engine and the motor to output shafts of the hybrid vehicle, and which includes a torque converter, a starting gear, and a clutch that controls an engagement state of the starting gear by being supplied with oil pressure;

a hydraulic control circuit associated with the transmission;

a motor-driven oil pump for supplying oil pressure to the hydraulic control circuit and the clutch;

an engine automatic stop and start device which is associated with the engine in order to stop and start the engine under predetermined conditions;

a control unit which is operatively connected to the engine automatic stop and start device, the motor-driven oil pump, and the hydraulic control circuit;

a brake pedal depression detecting device which is provided for detecting whether the brake pedal of the hybrid vehicle is depressed, and which is connected to the control unit; and

an accelerator pedal depression detecting device which is provided for detecting whether the accelerator pedal of the hybrid vehicle is depressed, and which is connected to the control unit,

wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is set to be a first oil

pressure while the engine is automatically stopped,

wherein the control unit is adapted to operate the engine automatic stop and start device so as to start the engine when it is determined by the brake pedal depression detecting device that the brake pedal is released while the engine is automatically stopped, and

wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is increased from the first oil pressure to a second oil pressure which is greater than the first oil pressure when the engine is automatically started upon detecting release of the brake pedal, and it is determined by the accelerator pedal depression detecting device that the accelerator pedal of the hybrid vehicle is depressed.

5. A hydraulic control apparatus for a hybrid vehicle comprising:

an engine and a motor as power sources of the hybrid vehicle;

a transmission which is provided for transmitting powers of the engine and the motor to output shafts of the hybrid vehicle, and which includes a torque converter, a starting gear, and a clutch that controls an engagement state of the starting gear by being supplied with oil pressure;

a hydraulic control circuit associated with the transmission;

a motor-driven oil pump for supplying oil pressure to the hydraulic control circuit and the clutch;

an engine automatic stop and start device which is associated with the engine in order to stop and start the engine under predetermined conditions;

a control unit which is operatively connected to the engine automatic stop and start device, the motor-driven oil pump, and the hydraulic control circuit;

a brake pedal depression detecting device which is provided for detecting whether

the brake pedal of the hybrid vehicle is depressed, and which is connected to the control unit;
and

an accelerator pedal depression detecting device which is provided for detecting whether the accelerator pedal of the hybrid vehicle is depressed, and which is connected to the control unit,

wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is set to be a first oil pressure during an idling stop operation of the engine,

wherein the control unit is adapted to operate the engine automatic stop and start device so as to start the engine when it is determined by the brake pedal depression detecting device that the brake pedal is released while the engine is automatically stopped, and

wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is decreased from the first oil pressure when the engine is automatically started upon detecting release of the brake pedal, and it is determined by the accelerator pedal depression detecting device that the accelerator pedal of the hybrid vehicle is not depressed, and then to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is increased to a second oil pressure which is greater than the first oil pressure when it is determined by the accelerator pedal depression detecting device that the accelerator pedal of the hybrid vehicle is depressed.

6. A hydraulic control apparatus for a hybrid vehicle comprising:

an engine and a motor as power sources of the hybrid vehicle;

a transmission which is provided for transmitting powers of the engine and the motor to output shafts of the hybrid vehicle, and which includes a torque converter, a starting

gear, and a clutch that controls an engagement state of the starting gear by being supplied with oil pressure;

a hydraulic control circuit associated with the transmission;

a motor-driven oil pump for supplying oil pressure to the hydraulic control circuit and the clutch;

an engine automatic stop and start device which is associated with the engine in order to stop and start the engine under predetermined conditions;

a control unit which is operatively connected to the engine automatic stop and start device, the motor-driven oil pump, and the hydraulic control circuit;

a brake pedal depression detecting device which is provided for detecting whether the brake pedal of the hybrid vehicle is depressed, and which is connected to the control unit; and

an accelerator pedal depression detecting device which is provided for detecting whether the accelerator pedal of the hybrid vehicle is depressed, and which is connected to the control unit,

wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is set to be a first oil pressure while the engine is automatically stopped, and

wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is increased from the first oil pressure to a second oil pressure when it is determined by the brake pedal depression detecting device that the brake pedal is depressed, and it is determined by the accelerator pedal depression detecting device that the accelerator pedal of the hybrid vehicle is depressed while the engine is automatically stopped.

7. A hydraulic control apparatus for a hybrid vehicle comprising:

an engine and a motor as power sources of the hybrid vehicle;

a transmission which is provided for transmitting powers of the engine and the motor to output shafts of the hybrid vehicle, and which includes a torque converter, a starting gear, and a clutch that controls an engagement state of the starting gear by being supplied with oil pressure;

a hydraulic control circuit associated with the transmission;

a motor-driven oil pump for supplying oil pressure to the hydraulic control circuit and the clutch;

an engine automatic stop and start device which is associated with the engine in order to stop and start the engine under predetermined conditions;

a control unit which is operatively connected to the engine automatic stop and start device, the motor-driven oil pump, and the hydraulic control circuit;

a brake pedal depression detecting device which is provided for detecting whether the brake pedal of the hybrid vehicle is depressed, and which is connected to the control unit;

an accelerator pedal depression detecting device which is provided for detecting whether the accelerator pedal of the hybrid vehicle is depressed, and which is connected to the control unit; and

an engine revolution rate measuring device which is provided for sensing revolution rate of the engine, and which is connected to the control unit,

wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is set to be a first oil pressure while the engine is automatically stopped,

wherein the control unit is adapted to operate the engine automatic stop and start device so as to start the engine when predetermined conditions for starting the engine,

regardless of the driver's intention to move the vehicle, are fulfilled while the engine is automatically stopped,

wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is decreased from the first oil pressure to a lower limit oil pressure when the engine is automatically started upon detecting a disturbance, it is determined by the brake pedal depression detecting device that the brake pedal is depressed, and it is determined by the accelerator pedal depression detecting device that the accelerator pedal of the hybrid vehicle is not depressed, and

wherein the control unit is adapted to control the motor-driven oil pump and the hydraulic control circuit so that the oil pressure applied to the clutch is increased from the lower limit oil pressure to a second oil pressure which is greater than the first oil pressure when it is determined by the engine revolution rate measuring device that the engine revolution rate exceeds the idling revolution rate.

8. A hydraulic control apparatus for a hybrid vehicle according to claim 7, wherein the lower limit oil pressure is set to be substantially zero.

9. A hydraulic control apparatus for a hybrid vehicle according to claim 7, wherein the predetermined conditions for starting the engine, regardless of the driver's intention to move the vehicle, include at least one of the cases in which a request is made by an air conditioning system of the hybrid vehicle to operate an engine-driven compressor, and in which a request is made to charge a battery, which is provided for operating the motor, because the state of charge of the battery is low.

10. A hydraulic control apparatus for a hybrid vehicle according to one of claims 1 to 9,

wherein the first oil pressure is set to be an oil pressure which is required for transmitting a creeping torque.

11. A hydraulic control apparatus for a hybrid vehicle according to one of claims 2 to 9, wherein the second oil pressure is set to be an oil pressure which is required for transmitting a maximum torque of the engine.

12. A hydraulic control apparatus for a hybrid vehicle according to one of claims 1 to 9, further comprising a mechanical oil pump which is driven by at least one of the engine and the motor, and which supplies oil pressure to the hydraulic control circuit and the clutch, wherein the control unit is adapted to operate the motor-driven oil pump when the engine is automatically stopped.